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Advances in Genome Editing and Future Prospects for Sorghum Improvement: A Review

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Abstract : Recent developments in targeted genome editing accelerated genetic research and opened new potentials to improve crops for better yields and quality. Given the significance of cereal crops as a primary source of food for the global population, the utilization of contemporary genome editing techniques like CRISPR/Cas9 is timely and crucial. CRISPR/Cas technology has enabled targeted genomic modifications, revolutionizing genetic research and exploration. Application of gene editing through CRISPR/Cas9 in enhancing sorghum is particularly vital given the current ecological, environmental, and agricultural challenges exacerbated by climate change. As sorghum is one of the main staple foods of our region and is known to be a resilient crop with a high potential to overcome the above challenges, the application of genome editing technology will enhance the investigation of gene functionality. CRISPR/Cas9 enables the improvement of desirable sorghum traits, including nutritional value, yield, resistance to pests and diseases, and tolerance to various abiotic stresses. Furthermore, CRISPR/Cas9 has the potential to perform intricate editing and reshape the existing elite sorghum varieties, and introduce new genetic variations. However, current research primarily focuses on improving the efficacy of the CRISPR/Cas9 system in successfully editing endogenous sorghum genes, making it a feasible and successful undertaking in sorghum improvement. Recent advancements and developments in CRISPR/Cas9 techniques have further empowered researchers to modify additional genes in sorghum with greater efficiency. Successful application and advancement of CRISPR techniques in sorghum will aid not only in gene discovery and the creation of novel traits that regulate gene expression and functional genomics but also in facilitating site-specific integration events. The purpose of this review is, therefore, to elucidate the current advances in sorghum genome editing and highlight its potential in addressing food security issues. It also assesses the efficiency of CRISPR-mediated improvement and its long-term effects on crop improvement and host resistance against parasites, including tissue-specific activity and the ability to induce resistance. This review ends by emphasizing the challenges and opportunities of CRISPR technology in combating parasitic plants and proposing directions for future research to safeguard global agricultural productivity.

Keywords : CRISPR/Cas9, genome editing, quality, sorghum, stress, yield
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